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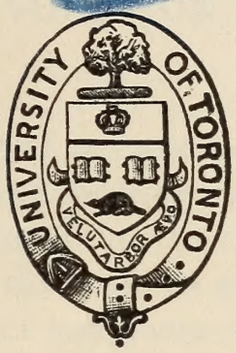

Opportunities

for

Graduates in Applied Science

and

Engineering

Copies of this bulletin may be obtained, free, on application to the Department of University Extension, University of Toronto, Toronto

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NATURE OF THE ENGINEER'S WORK—WHERE GRADUATES FIND EMPLOYMENT—FUTURE OF ENGINEERING AS A VOCATION

THERE is something alluring to most young men in the work of the engineer. It is enduring and constructive, containing for the observer evidences of substantial contribution to civilization. The satisfaction arising from the control and direction of great constructive or administrative enterprises is a distinct compensation for those who enter upon the exacting vocation of the engineer. Doubtless much of the favour with which engineering work is regarded by the youth of the country arises from the element of physical activity contained in the earlier positions and the promise of travel and adventure which holds to some extent throughout the career of the engineer.

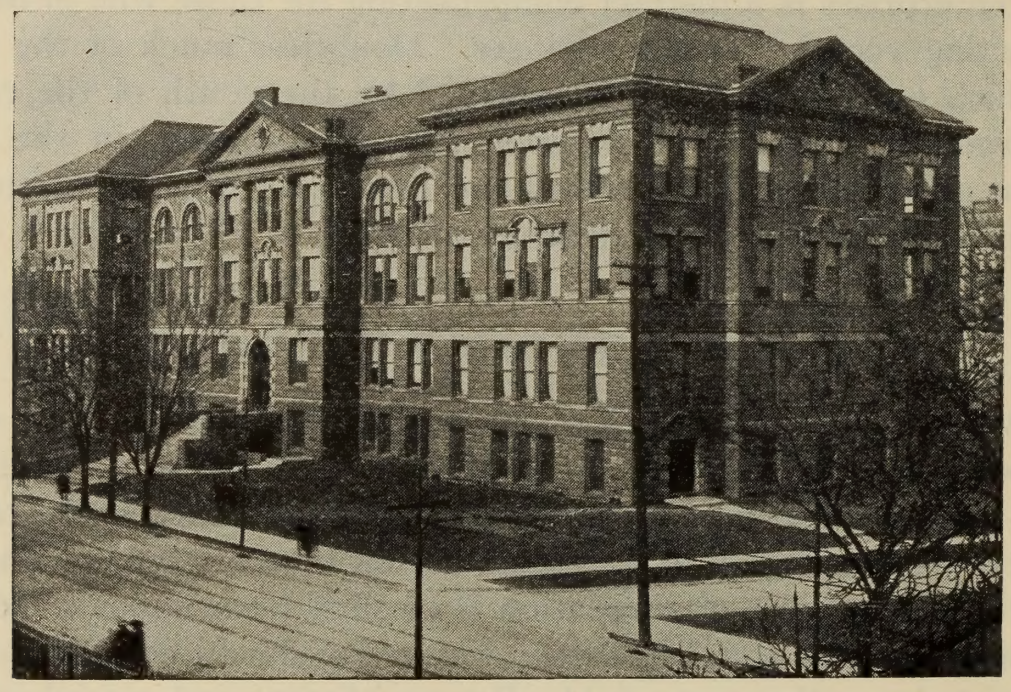
NEED FOR DEPENDABLE INFORMATION

However inviting the work of the engineer may be, there is danger that young men unsuited to this field may enter upon it through the urge of a passing fancy or a wave of enthusiasm created by learning of the fortunate experiences of someone who has been engaged on engineering work. The choice of a vocation is of such tremendous importance that the young man about to enter a university should be very sure that he does not choose the wrong field. Personal fitness and special aptitude for the distinctive work of the engineer are absolutely essential. Young men heretofore in contact with the work of the engineer and without knowledge of what it involves are in danger of making a misstep, unless guided in their choice. For this reason the present brochure has been prepared.

REQUISITES FOR SUCCESS IN ENGINEERING

While it is true that any young man with good physique and with average ability can earn a very good livelihood and attain to an honourable position in the community in the field of engineering, the highest success is attained only by those who possess to an unusual degree the enthusiastic, investigating, scientific type of mind with a pronounced leaning to practical affairs.

Immediate practical results with very pronounced regard for the economic situation are things with which the engineer is chiefly concerned. To obtain these he needs to know more than merely *how* to bring about a certain result. He must know *why* a certain course of action will unerringly give the result which he seeks; that is, he must above everything else be a practical scientist and not a mere technician working with tools. As between the mechanic, whose range of service is limited, and the scientific engineer, whose field is unlimited, there is the same difference as exists between the locomotive engineer and the designer of locomotives; between the operating engineer of a steam power plant and the engineer who planned it; between the roadmaster



THE MINING BUILDING

of a section of railway and the engineer who located and worked out the details of the construction and who supervises maintenance; between the plumber and the designer of sanitary systems for buildings. Young men who would become conspicuously successful in engineering must possess a trained scientific intelligence and that not merely of the mechanic or technician.

Most young men approaching engineering without knowledge of what it involves picture the work as largely of a technical character and look forward to positions of great scientific or technical prestige and importance. In the lower grades of engineering employment, the work which can best be done by the young engineer is of purely technical type; but, as his experience grows, the engineer who develops as he should

finds that there is greater and greater demand for his services in administrative or semi-administrative capacities. He no longer is a technical worker in a laboratory or at a drawing table, but must control, direct, and manage groups of workers in his own field or perhaps in widely diversified ones. In proportion as his capacity for direction and management extends will his earning power and employability in the profession increase. The type of man required for the most highly paid positions in engineering is one with sound technical knowledge and experience to which is added unusual capacity for direction and management and, as a third element, a sound economic sense and appreciation of the financial situation confronting his employer. It must not be forgotten, however, that some very valuable creative work will be carried out in the laboratory by those who have had a long training in Applied Science, and who are specially fitted by experience and temperament to pursue laboratory research as a life work.

It should be borne in mind by the young man entering engineering that it is not a soft life, but one requiring physical strength and endurance. The work at times is arduous, and in certain special circumstances involves exposure and danger, as the work of the engineer on reconnaissance of railways and in deep foundations and tunnels where work often is carried out under compressed air. The necessity for turning out an enormous quantity of work at short notice renders engineering in some of its aspects similar to the work of the law where cases must be thoroughly prepared for immediate court proceedings.

DIVISIONS OF ENGINEERING

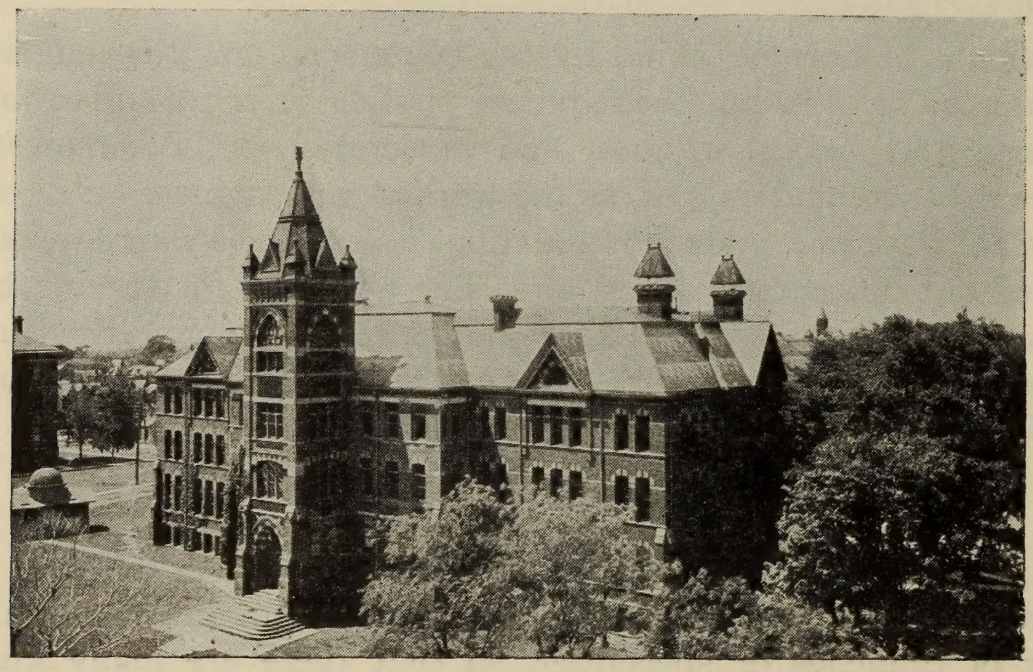
Development of engineering science has brought into being a great number of branches or specialties, so that there are many kinds of engineer. Thus, there are civil engineers, mining engineers, mechanical engineers, aeronautical engineers, chemical engineers, electrical engineers, metallurgical engineers, ceramic engineers, structural engineers, sanitary engineers, hydraulic engineers, highway engineers, and very many others. Within each specialty there may be engineers employed at varieties of tasks, such as the gathering of information with respect to an enterprise, planning and designing, constructing, installing, operating or maintaining works. However, most engineering colleges arrange courses in accordance with a few major sub-divisions or departments. In each of these the instruction is sufficiently broad in character to make it possible for graduates trained in one department to take up employment in another department with very little difficulty. Thus there have been such striking changes as a graduate in architecture becoming a hydraulic

engineer, and one in electrical engineering becoming a bridge engineer.

In the Faculty of Applied Science and Engineering of the University of Toronto there are seven Departments in which a student many graduate, *viz.*, civil, mining, mechanical, chemical, electrical and metallurgical engineering and architecture. In any one of these Departments, there is a great variety of specialties, any one of which would absorb a life's work.

EMPLOYMENT IN ENGINEERING

Preliminary to most civil engineering projects in the field are surveying and mapping. General maps of the country, prepared often in great detail by government service branches, establish boundaries and the



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configuration of the country with sufficient accuracy for general public use. Geodetic surveyors carefully determine the exact position of points great distances apart on the earth's surface by measurement of the greatest precision and in this work a few specially qualified men obtain permanent employment. Increasing use is being made of aerial methods of mapping the topography of remote regions. Work of governmental character is undertaken by the Topographical Surveys Branch, the Geodetic Survey, and the Geological Survey of the Department of the Interior of Canada. In addition to governmental employment, there is an opportunity for private practice as provincial land surveyors in each of the Provinces. Qualifying examinations in addition to those which

must be passed for graduation in an engineering college are necessary to entitle one to practise as a licensed land surveyor.

Although Canada at the present time is over-built so far as steam railways are concerned, there is a considerable field of employment on special railway projects of a local character and betterments open to engineering graduates. There are re-locations of portions of lines constantly going on and construction of these new sections, as well as improvement of terminals, perfection of safety devices, electrification of suitable zones, and the large general problem of maintenance and operation to be dealt with by railway engineers. Then, too, building of new railways in Canada is by no means wholly a thing of the past, for new lines are being contemplated in the North to open up new regions of the country.

Many problems arise for the transportation engineer in the construction, improvement, and operation of electric railways in and between urban municipalities. The engineer is peculiarly qualified to deal with operation and management problems of a utility of this kind, and it is probable that an increasing amount of employment will be found by engineers in this field.

Construction and maintenance of canals and ship channels afford employment for a number of engineers in the government service. During construction, employment with the contractors is often to be had but, after construction, such work as is carried out is done in the employ of the Dominion Government. While the Welland ship canal is the only large canal now under construction in Canada, there is a probability that the St. Lawrence and Ottawa may be improved in the near future, and there have been exhaustive reports and studies prepared on canalization on a large scale.

In recent years a very important source of employment for engineering graduates has been in the construction and maintenance of highways. The large provincial undertakings, in addition to the regular programmes of the counties and townships, have necessitated the employment of many men to carry out the work in hand. Location or re-location of highways, design of the cross section, fixing of grades, testing of materials, supervision of construction, maintenance under traffic, regulation of traffic, and associated activities have provided, and probably will continue to provide for some time, an important field for the young graduate. Some of those thus employed go into government service or into the service of municipalities. Not a few obtain satisfactory positions with supply houses furnishing materials and equipment for road-building operations.

Public appreciation of the importance of surveying and effectively

developing our power resources has given much attractiveness to hydraulic engineering as a field of employment. Government departments, notably the Water Power and Reclamation Service of the Department of the Interior of Canada, have employed many men in the collection of information concerning our water-power resources. Supplementing these there have been many investigations carried out by the various provincial power commissions, such as the Hydro Electric Power Commission of Ontario, which often employ staffs of considerable size. Following the collection and collation of hydraulic data by public organizations, there is undertaken, either by a governmental organization or by private enterprise, the development of specific powers. The young engineer may in this work be employed either by a governmental department or commission, or by a consulting engineer. In either event, there must be planned and designed the necessary dams, canals, flumes, headworks, power houses, and mechanical and electrical equipment.

Another phase of hydraulic engineering of importance in Canada is that which may be comprised generally under the term "reclamation." Drainage enterprises of considerable magnitude are often undertaken by municipalities under existing legislation and very extensive works have been and are being carried out for the irrigation of dry lands in the Canadian West.

Other engineering works involving applications of hydraulics are the control of rivers and lakes for the prevention of flooding or for purposes of navigation; protection of coast and shore lines; construction of harbour works and channels; construction, maintenance, and operation of city fire protection or water works. Employment may be had in some of these cases with governmental or municipal authorities and in others with private corporations or with consulting engineers. The necessities of town dwellers have made it vital that large and concentrated populations be supplied with water, light and pure air, and that all waste and filth be removed promptly in the interest of the public health. There must be sanitary and health regulations prepared and enforced which will ensure to urban and rural dwellers alike a healthful and comfortable existence. In this work many engineers are employed, both in municipal service and in governmental service. They may serve as supervising engineers for water supply plants, sewerage systems, sewage disposal works and refuse destructors during construction and as superintendents for them and similar public utility undertakings after completion.

In all construction operations, no matter what the nature of the works may be, there is opportunity for the employment of the structural engineer. His services are enlisted in the design and construction of bridges, buildings, foundations, towers, tunnels, subways, wharves, grain

elevators, dams, pipe lines, flumes, conduits, retaining walls, sea walls, locks, elevated railways, gas holders, tanks, sewers, chimneys, cranes, mine headworks, cableways, and related structures. On the part of bridge and structural steel companies, contractors, transportation companies, municipalities, power companies and commissions, and consulting engineers there has been in past years a steady demand for young men whenever construction was at all normal. It is believed that this demand will continue and that satisfactory employment may be found by a considerable number of engineering graduates each year in structural engineering pursuits.

Appreciation of the necessity for more careful planning of urban layouts has in recent years created employment for numbers of men qualified in town-planning. While the numbers that can be absorbed in this field are not great, they have been increasing and, apart from the few consulting engineers who may specialize in this field, there will be in municipalities a demand for employes with training in the science of town-planning and civic improvement.

Mining activity has been growing very rapidly in Canada, and particularly in Ontario, during the last few years. Prospecting is continually opening up new areas in our north country. Industrial growth is calling more and more for the production of non-metallic minerals which abound in the older parts of Ontario. All stages of mining work are profiting by improved scientific and technical methods and the engineer is being called upon in all phases of the work. It is being realized on all sides that the financial and the technical phases of the work are inseparable and the engineer is more and more carrying direct financial responsibility. Management and organization in the mining field are now almost exclusively in the hands of the technically trained man. On account of the extreme range of technical operations involved in the development of mining areas, mining plants, and metallurgical operations, the mining engineer is called upon for very wide foundations of knowledge. Building on this broader foundation we find them, in the larger mining organizations, specializing in many different directions; there is no branch of engineering that is not drawn upon in mining work. As mining is essentially work carried on for the main purpose of financial profit the engineer is becoming more and more concerned with the financial side of operation, promotion and management. On account of the frequent isolation of mining camps the mining engineer is responsible as well for housing, health and personal welfare.

Numbers of engineers are engaged by public or private corporations

on the design, construction, erection, testing, and operation of machines for the generation, transmission, and application of power. So numerous are such applications for the public use and for private industry, and so important is the basic factor of power that opportunities for employment in this field are, and will continue to be, numerous. In addition to fixed installations for the generation of power by steam, gas, oil, or the fall of water, there are many and extensive problems in the development of motive power on railways, highways, and waterways. An engineer is

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necessary in the development, improvement, and maintenance of means of transport of every kind.

In addition to his necessary service to the manufacturer of machinery, the engineer often finds a suitable field in the technical processes and direction of manufacture of all kinds. Thus, in a plant manufacturing such products as textiles, pulp, paper, woodenware, agricultural implements, rubber, cement, and the like, the mechanical engineer is a vitally essential official, for on his inventive talent and his capacity to devise special methods of equipment for doing new tasks will depend largely

the financial success of the industry. The handling of products, both in course of manufacture and in storage and transit, is an incidental activity in which the engineer finds his services in demand.

In the construction of modern buildings there are many points connected with equipment on which the engineer is often retained. Thus there is the large and difficult problem of heating, and the equally difficult one of adequate ventilation. In special buildings the problem of refrigeration may require skilful consideration and the services of a highly-trained engineer.

The problem of flight is now engaging much attention in Canada, both from the transportation and observation standpoints. The design of the flying machine and the problem of flight are now being taught at the University.

Specialization has brought about within recent years a demand for many technical graduates for electrical work and often in special phases of this field. In connection with the generation and transmission of power, as carried out either by governmental bodies or by private enterprise, the engineer is an essential factor. He is called upon to select the type of generator and auxiliary equipment for the power house, to determine the characteristics of the transmission line, to select suitable motors or other equipment for the utilization of the energy at the point of consumption. In the manufacture of such equipment engineers are employed in great numbers.

One of the important fields of activity for graduates in engineering has to do with transportation equipment. Thus the development of the system of transmission of power for electric railways and the utilization of it in the moving equipment is a common problem. Much of the safety of operation of steam railways depends upon the devising of suitable electric signalling systems, and there is an increasing activity on steam railways along the lines of electrification or the substitution of electric for steam motive power.

An important source of employment for engineering graduates has developed in communication engineering as comprised under telegraphic, telephonic, and radio communication, especially the last-mentioned. Employment is secured both from the companies operating such services and from the manufacturers of equipment used in them.

In those industries which involve electrical or electro-chemical processes it is necessary to have skilled engineering assistance. In ordinary, typical, manufacturing establishments, plant engineers, familiar with both mechanical and electrical equipment are indispensable and many are employed in such capacities.

Opportunities for graduates in Chemical Engineering have been multiplying rapidly in recent years. During the last quarter century a tremendous expansion has taken place in the application of the various branches of chemistry and engineering to many industries, of which some are purely chemical, while others depend partially upon chemical operations in some stage of production. The older methods of carrying out and controlling chemical processes, which were frequently haphazard and inefficient, have been supplanted by carefully organized systems

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under constant laboratory control. Moreover, modern investigation has led to such a vast development of entirely new products, and of new methods for making old ones, as to constitute what may fairly be termed a revolution in chemical industry. As a result there has been a linking-up of the work of the chemical laboratory with that of the designing and operating engineer which has given rise in recent years to the creation of university courses in Chemical Engineering in which the basic principles of both kinds of work are studied and correlated.

The men who have pursued this course fall broadly into three groups:

(1) those who after graduation have entered chemical plants as engineers directly concerned with production, and hence closely connected with both the manufacturing and managerial branches of industry; (2) those who have been more interested in the chemistry of the processes involved, their control and improvement, and have found employment in the laboratories of the industries in analytical and research work; and (3) those who have preferred to carry on work in university, government and municipal research laboratories dealing particularly with such subjects as biochemistry, foods, fuels, health, water and sewage disposal. The proposed expansion of industrial research by the federal and provincial governments will still further increase the demand for the man trained in industrial laboratory work, the expansion of which is rapidly progressing in this Department.

The raw materials utilized and the products manufactured from them in chemical industry are so numerous and diverse in nature as to permit the inclusion here of but a partial list of industries in which a Chemical Engineer may find employment as engineer, as chemist in management, or in combinations of these. In addition to the purely chemical industries engaged in the production of acids, alkalies, ammonia, chlorine, calcium carbide and cyanamide, pharmaceutical products, synthetic resins such as Bakelite, quick-drying nitrocellulose lacquers such as Duco, etc. etc., there are a great many industries in which chemistry plays a very important part, such as: pulp and paper, rubber, paints and varnishes, petroleum products, sugar, meat and edible fats, leather, glue, malt products, brewing, industrial alcohol, flour and related products, coal tar industries with all their ramifications in dyes, drugs, photographic developers, explosives, perfumes, etc., wood distillation, Portland cement, abrasives, metallurgical industries, fertilizers, etc. etc. There will undoubtedly be an increased demand in the world for men trained to deal effectively with its raw materials in chemical transformations. The governments of the world have awakened to the great value and importance of chemical industry both in the daily life of the people and in the economic production of the nation, and are accordingly lending their aid to the stimulation of research, the creation of new industries and the improvement of those already in existence. The dual nature of the training in chemical engineering, as implied in the name itself, should prepare a man to enter and play a successful part somewhere in this huge modern development of chemical industry.

Graduates in Metallurgical Engineering obtain employment in plants producing metals from ores. Metals so produced may be worked, mixed or alloyed for industrial use. Such operations furnish further

opportunities for technically trained men. Necessarily an important feature of the training of the metallurgical engineer is laboratory investigation and research. As a result of increasing activity in metal mining, Canada is now entering on an era of high production of metals. It is expected that the demand for metallurgists will continue to increase. Graduates in Metallurgy find ready employment in plants where metals are produced. The involved treatment of copper, zinc and lead ores demands greater metallurgical control than do gold ores. The present

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extensive development throughout Canada of zinc ores, containing either lead or copper and frequently both metals, promises abundant employment for Metallurgists. In order to obtain broader metallurgical experience graduates in Metallurgy sometimes prefer to find employment with some of the larger metallurgical plants in the western and south-western states, or with the refineries on the Atlantic seaboard. It is probable that the largest field of employment for graduates in metallurgical engineering in Canada will for the next twenty years be in plants where metals are produced from ores. However, the steady increase in metal-

working industries in Canada is creating a growing demand for Metallurgists.

The Ceramic Division of the Department of Metallurgy was begun in 1925 at the request of the Canadian National Clay Products Association, as it was felt that there is a definite need for technically trained engineers in the ceramic field.

The first two years of the course are devoted to general engineering subjects. The third and fourth years are given over largely to ceramics, the whole giving a well rounded engineering training with special emphasis on ceramic engineering. The ceramic industry is divided into seven divisions, 1—heavy clay products, 2—terra cotta, 3—whiteware, 4—glass, 5—enamelled iron, 6—refractories and 7—art. All of these divisions are covered in the course except ceramic art.

The present value of clay products manufactured in Canada is a little over ten million dollars per year. This does not include enamelled iron, glass or feldspar. The ceramic industry in Canada is growing steadily and the graduate student entering it now will be a pioneer in applying technical knowledge to its problems.

ADMINISTRATIVE WORK

Of recent years the importance of the field of administrative or managerial work for engineering graduates has come strongly to the fore. It has been found that technical graduates with a capacity for business do unusually well in executive or managerial positions. It probably will come about that an important percentage of graduates from engineering colleges in Canada will find their way ultimately into this kind of work. It is undoubtedly as legitimate a field for the activities of the technically trained man as the purely scientific work of the technician. For positions in industry as junior or senior executives, there are available from time to time important posts as directors of large enterprises of a public or private character. For example, there is a growing popularity in America for the city manager form of government, and of some 400 city managers in Canada and United States, at the time of writing, probably 40 per cent. are technically trained men. In municipal departments, particularly departments of works, administrative positions of great importance are commonly held by engineers. A field of growing importance for technical graduates is that which is sometimes called sales engineering. Many manufacturing companies supplying construction materials, machinery, and equipment find it most desirable to employ for sales purposes young men who have had a technical training,

and many have found both pleasant and profitable employment in this field of work.

On this account there is some advantage to young men with an engineering education in giving attention to broader fields of associated subjects, so that as they gain experience after leaving the university, they will have some degree of familiarity with business and technical subjects in combination.

It is, therefore, to be expected that many young men who have some liking for technology, but who are not equipped for the highest success in purely chemical pursuits, may be conspicuously successful in executive work requiring only a moderate capacity for the technical side of engineering.

CONTINUITY OF EMPLOYMENT

In the work of the engineer there is sometimes a certain discontinuity. This is particularly true of construction work and the work of the designing engineer associated with it. In times of depression, construction is likely to be suspended until the skies are clearer. However, those employed in this kind of work manage to secure employment in some other field with an ease which depends upon their experience and adaptability. Those branches of engineering which have to do with the manufacture of staple commodities or products are likely to be the most steady sources of employment.

It is frequently stated that engineers do not receive the compensation which their training and experience would warrant. There are no statistics available which would show the relative earnings of engineers and those employed in the other professions. However, it is probably true that the first-class engineer earns quite as much as a practitioner in any of the other professions in the same grade of achievement and in many cases more so in recent years. While the earnings of the engineer rarely rise out of the moderate class, they are, for those who are properly qualified, have a taste for the work and diligently apply themselves, quite sufficient to maintain a position of dignity and comfort. A young man who is fitted for engineering need have no fear of his inability to get on in a financial sense.

FUTURE OF ENGINEERING

To the oft-repeated questions as to the probable future of engineering, the answer may be given that there are arising from time to time new and difficult problems which can only be solved satisfactorily by the engineer. The increasing complexity of civilization brings with it vast and compli-

cated problems relating to the supply of fuel, power, transportation facilities, and the like. So long as these tasks exist there will be employment for the engineer. This is especially so in Canada.

While a generation ago a great deal of the engineering of the country was done by consulting firms, the tendency of the time appears to be towards an increasing amount of engineering being done by the engineering staffs of public bodies working on a salary basis. Most municipalities now have an engineer, or perhaps many engineers, regularly in their employ, making it necessary to retain the expert consulting engineer only on special or extensive problems. The increasing tendency of governments to undertake enterprises which formerly were launched by private corporations has brought a large amount of employment to engineers in the Government or governmental commission service. It is probable that this tendency will continue.

THE FOLLOWING APPENDIX GIVES THE VARIOUS BRANCHES OF ENGINEERING FOR WHICH GRADUATES HAVE RECEIVED PREPARATION IN THE FACULTY OF APPLIED SCIENCE AND ENGINEERING

The following is an outline of various branches and sub-divisions of Applied Science and Engineering for which graduates in the various departments in this Faculty receive fundamental technical preparation.

This is supplemented by practical experience in both field and shop during summer vacations, which has been obligatory in the Departments of Mechanical, Electrical, Mining and Metallurgical Engineering. In the Civil and Chemical Engineering Departments in which there is a wide diversity of work, graduates have had various kinds of engineering and scientific employment in summer vacation, during which many of them have secured useful experience. Such university training and practical experience as is obtained will enable a graduate to be immediately useful under proper supervision, in office, laboratory, shop or field.

Many graduates gain valuable preliminary experience in general business methods, in offices and elsewhere.

CIVIL ENGINEERING—TRANSPORTATION; steam and electric railways, ship canals, river improvement. PUBLIC WORKS; including harbours, docks, navigation, river and flood control. MUNICIPAL; water supply, drainage, sanitation, streets and pavements, traffic and town planning. SURVEYING; including mapping, geodetic and topographical work, aerial surveying. HYDRAULIC; hydro-electric power development, water supply and control, pumping, dams, canals, reservoirs, also irrigation and reclamation work. STRUCTURAL; foundations, buildings of all descriptions requiring engineering treatment in design and construction in steel, brick and concrete. BRIDGE; connected with foregoing, steel and reinforced concrete bridges and fabrication of all material and its inspection. HIGHWAY; closely related to transportation and municipal, location, foundations and road surfacing, and structures accompanying. CONTRACTING; engineering connected with all kinds of works usually built under contract, included in the foregoing.

MINING ENGINEERING—Exploration of mining areas for government departments and commercial organizations, including geological surveying and mapping. Examination of, and reporting on, mining properties in regard to present value and future development. Mine Management. Investigation, design, construction and operation of mining plants, including both underground and surface equipment for power distribution, transportation, hoisting, mining and milling operations. Surveying, including topographical and underground surveying. Sampling and estimation of ore reserves and metallurgical products. Assaying and metallurgical analyses. Cost-keeping. Research work in all branches of mining and milling operations. Safety Engineering, including Social Welfare. Also, due to the increasing need of technical knowledge, positions as foremen and shift bosses. Sales and Service Engineers, and other financial operations connected with mining.

MECHANICAL ENGINEERING—The design, construction, erection, testing and operation of machines for the generation, transmission and application of power to the various demands of industry. More particularly: POWER GENERATION; steam, gas, oil and hydraulic, especially hydro-electric. TRANSPORTATION; motive power for steam and electric railways, automobile and trucks, aeroplanes, marine engines. MANUFACTURE; machinery of all kinds for milling, textiles, pulp and paper, wooden ware, agricultural implements, tools, rubber, leather, and for production of basic materials, steel, oil, cement, clay products. HANDLING of MATERIALS; conveyors, cranes, dock equipment. HEATING: ventilation and refrigeration. AERONAUTICS; Design and construction of aeroplanes, etc.

ELECTRICAL ENGINEERING—Investigation, design, construction and operation of equipment and devices for generating, transmitting, distributing and applying electricity for all purposes. POWER; by hydro-electric, steam and oil generation. TRANSPORTATION; by electric railways, urban and suburban and trunk and all equipment connected with them. ILLUMINATING; involving all phases of electric lighting and its application. COMMUNICATION; including telegraph, telephone and radio. MANUFACTURE; the application of electricity to all forms of manufacture by motors and other appliances either in new works or by electrification of existing ones, involving efficiency surveys; application to electro-chemical processes; the manufacture of all kinds of electrical machinery and apparatus for public utilities and industrial and domestic uses. OPERATION; the process of operating electrical plants, machinery and apparatus for all purposes.

CHEMICAL ENGINEERING—The design, construction and operation of plant for the production of chemical products of all kinds; operation, investigation and control in numerous branches of manufacturing, such as in factories producing rubber goods, leather, pulp and paper, soap, oils of all kinds, meat products, flour and other food stuffs, illuminating gas, glass, paints and varnishes, Portland cement, printing inks, sugar, salt, glue, etc.; and in dye houses, distilleries, electro-chemical plants and many other works. The chemical engineer can render valuable services wherever raw materials are compounded or mixed or altered in their nature. For those who have been trained in industrial chemical research there is a growing field in the laboratories maintained or projected by various industries, by the Government and by the universities.

METALLURGICAL ENGINEERING—The PRODUCTION of metals from the ores produced by mining engineering and the WORKING of the metals so produced, including alloys and their treatment. This involves INVESTIGATION AND RESEARCH in the laboratory and STUDY of the design, construction and operation of metallurgical plants comprising furnaces, foundries, smelters, refineries and lixiviation works.

CIVIL SERVICE—A large demand for graduates in Applied Science comes from the Civil Services of the Provinces and the Dominion. These absorb graduates from

every department and in very many of the branches outlined above in both technical and administrative work.

BUSINESS AND GENERAL—As Applied Science and Engineering involves so much in economic development, there is a great demand for young, technically trained men in the BUSINESS SIDE of many industries and business organizations where they can quickly adapt themselves and become especially useful in COST-KEEPING, SALESMANSHIP and other branches of BUSINESS leading up to administrative and executive positions.

NOTE.—The foregoing outline is merely suggestive and is not intended to be complete or detailed.

MATRICULATION

A candidate for admission to the First Year in the Faculty of Applied Science and Engineering must produce satisfactory certificates of good character and of having completed the seventeenth year of his age on or before the first of October of the year in which he proposes to register.

He must also present certifiates giving him credit in the following subjects of Pass and Honour Matriculation:

PASS MATRICULATION

ENGLISH (Literature and Composition)
HISTORY (Canadian and Ancient) *or*
CANADIAN HISTORY and MUSIC
MATHEMATICS (Algebra and Geometry)
Any three of
LATIN (Authors and Composition)
GREEK (Authors and Composition)
FRENCH (Authors and Composition)
GERMAN (Authors and Composition)
SPANISH (Authors and Composition) *or*
ITALIAN (Authors and Composition)
EXPERIMENTAL SCIENCE (Physics and Chemistry) *or*
AGRICULTURE (Parts I and II)

*ARITHMETIC *and* Certificates in MECHANICAL DRAWING and SHOP WORK from the Principal of the School, accompanied by an approving certificate from the Director of the Technical School Branch of the Department of Education for Ontario.

HONOUR MATRICULATION
(At least 50%)

ENGLISH (Literature and Composition)
MATHEMATICS (Algebra, Geometry and Trigonometry)
**Physics
One of:
LATIN (Authors and Composition)

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*This option applies to students—and to such students only—who have been in attendance at and matriculate from a Technical School in the Province of Ontario and are certified as such by the Department of Education of the Province.

**Takes effect for Matriculation in 1929.

GREEK (Authors and Composition)
FRENCH (Authors and Composition)
GERMAN (Authors and Composition)
SPANISH (Authors and Composition)
ITALIAN (Authors and Composition)

In selecting the options it is recommended that students take French, German and Experimental Science. In the Department of Architecture, French is recommended; in the Departments of Chemical Engineering and Mechanical Engineering it is desirable that students take German. For students intending to take Metallurgical Engineering, Spanish and Experimental Science are recommended.

The regulations respecting Matriculation, together with a schedule of examinations which may be accepted as equivalent, may be found in the Curriculum for Matriculation on application to the Registrar of the University.

A candidate from the British Isles must present a certificate showing that he has passed or has exemption from the Preliminary Examination of the Institution of Civil Engineers.